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U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF CHEMISTRY.

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THE FERTILIZING VALUE OF STREET SWEEPINGS.

AN INVESTIGATION MADE UNDER THE DIRECTION OF

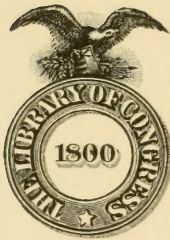
H. W. WILEY,
CHIEF CHEMIST,

BY

ERVIN E. EWELL,
FIRST ASSISTANT CHEMIST.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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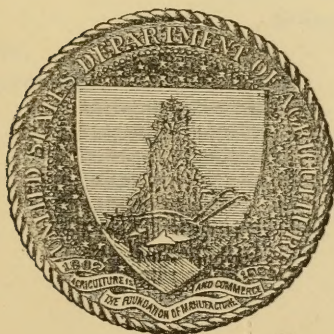
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LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
Washington, D. C., June 21, 1897.

SIR: I have the honor to submit for your inspection and approval the accompanying manuscript of the report of the investigation of the fertilizing value of street sweepings, which you authorized to be undertaken by this division on May 26, 1897. It is believed that the information resulting from this investigation will be of assistance to city officials who are seeking to extend the use of street sweepings in agriculture, and also be of benefit to farmers and gardeners to whom such materials may be available. I recommend that this report be published as a bulletin of this division, and that it be circulated as an aid in improving the methods employed for the collection of street sweepings and in extending their use for the maintenance of the productiveness of American farms and gardens.

Respectfully,

ERVIN E. EWELL,
Acting Chief of Division.

Hon. JAMES WILSON,
Secretary.

97.5.15.29.06.22

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THE FERTILIZING VALUE OF STREET SWEEPINGS.

DATA IN REGARD TO THE QUANTITY AND METHODS OF DISPOSITION OF STREET SWEEPINGS IN THE UNITED STATES.

In accordance with an authorization of the Secretary of Agriculture, dated May 26, 1897, the Division of Chemistry sent circular letters of inquiry to the officials in charge of street-cleaning departments in the 354 cities and towns of the United States having 10,000 or more inhabitants. More or less complete data in regard to the disposal of the street sweepings of 204 cities and towns were thus obtained. Estimates of the number of tons of sweepings collected annually in 81 of these cities were received. In compiling the data in regard to disposition, the methods of disposal have been divided into three classes: Utilization for fertilization, utilization for filling low land, and dumping wherever most convenient without any regard to the possible value of the materials.

In the first class are included all cities which succeed in disposing of some portion of their street sweepings for agricultural purposes, including many cases in which only a very small percentage of the total amount of sweepings is so used. The second class includes all cases in which no attempt is made to turn to account the fertilizing value of the material, but in which some part of the material is used for filling in low land, for reclaiming marsh land, etc. The third class includes those cities where the material is dumped in streams or other bodies of water, or on land, without any systematic attempt at utilization.

A summary of the data obtained is presented in the following table, in which the figures for population are taken from the reports of the Eleventh Census:

Data in regard to the amount of street sweepings collected in the cities of the United States, and the methods in use for their disposition.

	Cities reporting—				Cities which furnished no report.	Total for all cities to which inquiries were sent.
	Use of street sweepings for fertilization.	Use of street sweepings for filling.	No system of utilization.	Total.		
<i>Data in regard to methods of disposition.</i>						
Number of cities having—						
10,000 to 14,999 inhabitants.....	15	24	32	71	67	138
15,000 to 24,999 inhabitants.....	17	20	19	56	36	92
25,000 to 49,999 inhabitants.....	13	16	5	34	32	66
50,000 to 99,999 inhabitants.....	10	4	8	22	8	30
100,000 or more.....	5	10	6	21	7	28
Total number of cities.....	60	74	70	204	150	354
Per cent of total number of cities to which inquiries were sent.....	16.95	20.90	19.77	57.62	42.38	100
Urban population represented:						
Number of inhabitants.....	2,949,569	5,157,764	3,887,182	11,994,515	5,442,882	17,437,397
Per cent of total population of the 354 cities.....	16.92	29.58	22.29	68.79	31.21	100
Average population of the cities of the different groups.....	49,160	69,700	55,531	58,796	36,285	49,258
<i>Data in regard to the quantity of street sweepings collected annually.</i>						
Number of cities reporting tonnage, divided according to method of disposition:						
Number of cities having—						
10,000 to 14,999 inhabitants...	7	6	8	21	117	138
15,000 to 24,999 inhabitants...	11	7	4	22	70	92
25,000 to 49,999 inhabitants...	6	9	1	16	50	66
50,000 to 99,999 inhabitants...	4	3	2	9	21	30
100,000 or more.....	3	6	4	13	15	28
Total number of cities.....	31	31	19	81	273	354
Per cent of the total number of cities to which inquiries were sent.....	8.76	8.76	5.36	22.88	77.12	100
Urban population represented:						
Number of inhabitants.....	1,672,750	3,450,028	1,173,542	6,305,320	11,132,077	17,437,397
Per cent of the total population of the 354 cities.....	9.59	19.84	6.73	36.16	63.84	100
Average population of the cities of the different groups.....	53,960	111,581	61,765	77,843	40,777	49,258
Total number of tons collected annually.....	174,931	673,791	216,235	1,064,957	.....	.....
Number of tons collected annually, per 1,000 inhabitants.....	104.6	194.8	184.3	168.9	.....	.....

From an examination of these data it appears that 68.79 per cent of the people in the United States living in urban communities having 10,000 or more inhabitants were represented in the reports in regard to the disposal of street sweepings, while no reports were received from cities representing 31.21 per cent of our urban population. Of the 354 cities to whom inquiries were sent 57.62 per cent reported methods of disposition, showing that among the cities reporting there was a preponderance of those above the average size. This is also apparent

from the figures given in the table for the average population of the cities in the different groups.

By the reports received it is shown that the cities containing 16.92 per cent of our urban population make more or less effort to utilize the fertilizing value of their sweepings. If the same proportion prevails in the case of the cities from which no reports were received this figure should be increased to 24.6 per cent. In general terms it may be stated that the cities representing one-fourth of the urban population of the country make an effort to utilize the fertilizing value of some portion of their street sweepings.

The data reported in regard to the quantity of street sweepings collected annually were still less complete than the data in regard to methods of disposition; only 36.16 per cent of our urban population was represented in the reports in regard to the quantity of street sweepings collected annually. For the cities reporting, the average quantity collected annually is 168.9 tons per 1,000 inhabitants. Assuming this to be a true average for all of the cities of the United States, the total quantity of street sweepings annually collected may be estimated at not far from 3,000,000 tons.

The data contained in the reports relating to the cost of street cleaning in the various cities of the country were not sufficiently complete and satisfactory to justify their tabulation. In many cities the amount of money used for this purpose can not be separated from amounts used for other purposes. In other cases mere estimates were given for the cost per ton. The dearth of records of this sort in many cities renders the compiling of data impossible, and in many other cases it is extremely difficult to obtain complete statistical data without sending an agent to each city. While this would be very expensive in connection with an investigation of this kind, it might be very economically and satisfactorily done in connection with our regular census enumeration. It was necessary to send a second request to many of the cities before some of the data which we have presented were obtained. As appears from the table nearly one third of the cities did not respond to either inquiry.

CIRCUMSTANCES WHICH DETERMINE THE FERTILIZING VALUE OF STREET SWEEPINGS.

The fertilizing value of street sweepings varies greatly with the nature of the pavements, being practically nothing in the case of material taken from macadamized roads, and approaching that of good stable manure in the case of that collected on the hand-swept and well-paved streets of crowded cities. The regulations in different cities governing the nature of substances which may be thrown into the alleys and streets, and thus find their way into the material collected by the sweepers, vary so greatly that there is consequently a corresponding difference in the cost of sorting and preparing the material

for spreading on the land. It is believed that the rapidly increasing sentiment in favor of the careful separation and systematic utilization of all forms of city wastes will tend to remove this difficulty and thus increase the value of sweepings, particularly of those collected in alleys, where the percentage of miscellaneous rubbish is now often very great.

In autumn the quantity and, in many cases, the quality of the street cleaner's product is greatly increased by the falling leaves.

ANALYSES OF STREET AND ALLEY SWEEPINGS.

The range of composition of the sweepings collected by various methods on well paved streets and alleys at different seasons of the year is quite well exhibited in the following table of analyses of typical samples of sweepings collected on the streets of Washington, D. C. The analyses were made in the laboratory of this Division; the nitrogen determinations, by Mr. T. C. Treseot; the potash determinations, by Mr. George E. Patrick; and the determinations of moisture, ash, and phosphoric acid, by Mr. C. C. Moore. The determination of the phosphoric acid and potash contained in the organic part of street sweepings, without including that contained in the soil which is mixed with them, is not a simple problem. For the determination of phosphoric acid the method of the Association of Official Agricultural Chemists was used, the solution being prepared according to method A₂ (see p. 12 of Bulletin 46 of this Division); for the potash determinations the official method was followed, with the exception of the omission of the sulphuric acid used in burning off the organic matter; the official Kjeldahl method was used for the determination of nitrogen.

Analyses of street and alley sweepings, etc., collected in Washington, D. C.

(Analytical data are stated in percentages of the original material in its moist condition.)

Serial No.	Dates on which samples were taken.	Description of samples.	Moisture.	Ash.	Organic matter.	Nitrogen.	Phosphoric acid (P ₂ O ₅).	Potash (K ₂ O).
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
17014	1898. Feb. 8	Sweepings collected by hand on Pennsylvania avenue (asphalt pavement) and sold to a Virginia farmer for 25 cents per 2-horse load. The sample was taken from a pile which had lain on the dump at Twenty-first and B streets SW. for not more than 2 days				0.33		
17015	Feb. 8	Machine-collected sweepings, which were practically all leaves, taken from the streets in various parts of the city in the autumn of 1897. The sample was taken from the undecayed, dry leaves on the surface of a pile on the dump at Twenty-first and B streets SW. The analysis was made of the air-dry material.				1.18		
17016	Feb. 8	The same as No. 17015, except that the sample was taken from the wet, interior, decayed part of the pile				.32		
17019	Feb. 11	Street sweepings taken from stone-block pavement on Fourteenth street, between B and C streets SW. First cleaning after the melting of the snow. Street was very dirty				.27		

Analyses of street and alley sweepings, etc., collected in Washington, D. C.—Continued.

Serial No.	Dates on which samples were taken.	Description of samples.	Moisture.	Ash.	Organic matter.	Nitrogen.	Phosphoric acid (P_2O_5).	Potash (K_2O).
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
17020	1898. Feb. 11	Street sweepings taken from asphalt pavement on B street SW., between Thirteen-and-a-half and Fourteenth streets SW. First cleaning after the melting of the snow. Street was very dirty.....	-----	-----	-----	.25	-----	-----
17034	Feb. 23	Taken from stone-block pavement on B street NW., between Fourteenth and Fifteenth streets NW., where snow, taken from other parts of the city, had been dumped and allowed to melt.....	-----	-----	-----	.17	-----	-----
17214	May 13	Street sweepings from the dump at Fifteenth and C streets SW. The sample was a composite one, made from several piles, which were 6 to 8 months old.....	45.7	38.0	16.3	.30	0.08	0.09
17215	May 13	Street sweepings from the dump at Fifteenth and C streets SW. The sample was taken from a pile which was largely composed of leaves, which had lain on the dump for 6 to 8 months.....	37.5	49.3	13.2	.25	.01	.09
17216	May 13	Street sweepings from the dump at Fifteenth and C streets SW. The sample was taken from a pile which was mostly manure, and which had lain on the dump for 6 to 8 months.....	28.7	56.8	14.5	.32	.08	.11
17218	May 14	Machine-collected sweepings, taken from the dump at Twenty-first and B streets SW. The material had lain on the dump but a few days. It contained a very large proportion of sand.....	6.2	76.4	17.4	.32	.04	.18
17219	May 14	The same as No. 17218, except that the material appeared to consist principally of manure.....	16.4	48.1	35.5	.73	.16	.31
17220	May 14	Fresh, hand-swept sweepings (from asphalt pavement) taken from the dump at Twenty-first and B streets SW. The material was largely composed of manure.....	39.5	31.6	28.9	.55	.10	.37
17221	May 14	Material from "sewer drops," taken from the dump at Twenty-first and B streets SW. Of the same origin as No. 17221, but the material had a decidedly different appearance (nearly all sand).....	40.5	36.2	23.3	.56	.08	.16
17222	May 14	Alley sweepings, 3 to 4 weeks old, taken at the dump at Half street SE., between N and O streets. A large percentage of coarse rubbish was separated from the sample before it was prepared for analysis..	29.5	54.0	16.5	.31	.10	.08
17224	May 14	Decayed street sweepings, taken from the face of the bluff at the dump at Twenty-fourth and N streets NW. A composite sample made up of portions taken from several parts of the dump.....	16.4	66.6	17.0	.47	.02	.12
17225	May 14	The same as No. 17224, except that the sample was taken from a single place, which appeared to be especially rich.....	36.6	49.6	13.8	.41	.08	.13
17226	May 14	The same as No. 17220, except that the material had lain on the dump for 2 to 4 weeks.....	30.0	59.7	10.2	.39	.06	.17
17227	May 14	A sample of fish refuse, taken from the dump at Half street SE., between N and O streets..	52.3	18.0	29.7	.65	.10	.50
			28.1	18.6	53.3	9.15	6.79	.05

There seems to be a dearth of recent literature on the subject of the fertilizing value of street sweepings. J. H. Vogel published two short papers¹ on this subject, in which he included an analysis of sweepings

¹Mitteilungen der deutschen Landwirtschafts-Gesellschaft, 1892, 7, 89-90, and Deutsche landwirtschaftliche Presse, 1892, 19, 1056; Experiment Station Record, 4, 222 and 518.

taken from the asphalt-paved streets of Berlin. This material had the following composition:

	Per cent.
Moisture	39.89
Ash	37.67
Organic matter	22.44
Total nitrogen .....	.479
Ammoniacal nitrogen .....	.004
Total phosphoric acid (P_2O_5) .....	.452
Potash (K_2O) .....	.370
Lime (CaO)	1.891
Magnesia .....	.347

A sample representing the accumulation for four weeks of the sweepings from one of the streets of Trenton, N. J., was analyzed in the laboratory of the Agricultural Experiment Station of that State, with the following results:¹

	Per cent.
Nitrogen	0.18
Phosphoric acid (P_2O_5) .....	.30
Potash (K_2O) .....	.19

The station valued this material at 90 cents per ton.

FIELD TESTS OF THE FERTILIZING VALUE OF STREET SWEEPINGS.

We have endeavored to supplement the analytical data just presented with the results of practical tests made by farmers to determine the value of street sweepings as a source of plant food for field and garden crops, and as a source of the humus which is so necessary to a good mechanical condition of many soils. Inquiries sent to farmers and gardeners, whose addresses were furnished by the officials in charge of the street-cleaning departments in various parts of the country, brought a number of letters containing much information on the subject, and, as the following quotations will show, convincing evidence that well-selected and judiciously used street sweepings possess considerable manurial value. The letters describe some of the more successful methods in use for the treatment of street sweepings and for applying them to the soil. It will be noted that of sixteen letters only four report unfavorable results.

EXTRACTS FROM LETTERS FROM FARMERS AND GARDENERS WHO HAVE USED STREET SWEEPINGS FOR THE FERTILIZATION OF FIELD AND GARDEN CROPS.

ATLANTA, GA., *September 7, 1897.*

I have used street sweepings from Atlanta on my little farm with very good results. I find a ton of these sweepings equal to about half ton of housed stable manure of about two-thirds cow and one-third horse manure, provided the sweepings are gathered in the spring, fall, and winter months from clean pavements. The sweepings gathered in the hot summer months, taken from hot pavements with a hot sun, lose their fertile qualities in a great degree. As to garbage and sewage, I never used any as fertilizer, except when small quantities of garbage would get mixed with the

¹Report of the New Jersey Agricultural Experiment Station for 1895, page 92; Experiment Station Record, 8, 877.

sweepings. I have used the sweepings for three years, for corn, oats, wheat, rye, and potatoes, broadcasting about twenty tons to the acre on semiclay and sandy lands. My lands have been greatly improved, more than doubling their yield. On a large proportion of my land I follow the wheat, rye, and oats with a second crop (of corn) the same season, without additional fertilizer. * * *

The cost will approximate about 75 cents per ton. I have no trouble with tin cans, and not much with paper or other rubbish.

J. L. MCCOLLUM.

NEW HAVEN, CONN., *September 7, 1897.*

I have used street sweepings, with fair results, as a fertilizer.

A. N. FARNHAM.

ATLANTA, GA., *September 8, 1897.*

I have had experience only with street sweepings which comprise almost exclusively the droppings of horses on the streets of Atlanta paved with asphalt and Belgian blocks. I first used a half carload, or, in other words, twelve 2-horse wagon loads of street sweepings, on about an acre and a third (nine loads per acre), at my place near Marietta, 20 miles above this city. The remainder of the 5-acre tract, with this acre and a third, was planted in corn. In October I gathered four and a half 2-horse loads of corn—in other words, about 45 bushels on the acre and a third; and the other three and two-thirds acres only produced three and a half wagon loads—in other words, the very small yield of 35 bushels. It is fair to state, however, that the acre and a third had been planted in pease the year before, whereas the three and two-thirds acres had been left in Bermuda grass, which had been its condition for some years. There was nothing more than a general lesson taught by that experience.

Last fall, however, I broadcast the street sweepings at the rate of about thirty or more 2-horse wagon loads to the acre and planted the land in winter grazing oats. On a portion of the same tract immediately adjoining this I placed no street sweepings at all, although I had pease planted on the land last year. When I thrashed my oats, early in June, the tract upon which the street sweepings had been broadcast produced within a slight fraction of 50 bushels per acre, whereas on that which had no street sweepings I produced only 7 bushels per acre—an overwhelming proof of the value of street sweepings as a fertilizer.

I also have a lot of corn this year, fertilized with street sweepings, which has been described by a number of competent witnesses as the finest upland corn they have ever seen. It is proper, however, to say that, in addition to broadcasting 50 or more loads of street sweepings per acre on this corn land, I also last December plowed the land with a turning plow, which went down about 11 inches, and followed this with a scooter 6 inches broad as a subsoil plow, which went an average of 7 inches deeper, thus making the average depth of the plowing 18 inches. I believe that this very deep plowing helped the corn as much as any other factor by reason of the storing up of moisture during the winter, upon which the corn plant fed during the spring drought of forty-three days, within which period the corn of every neighbor I have turned yellow, while mine maintained a dark, green, healthy color.

I also fertilized a piece of ground liberally with street sweepings and planted it in sorghum millet, and have what is estimated a phenomenal yield.

Furthermore, I broadcast the street sweepings heavily, and after plowing in I broadcast pease, and have the statement of the State commissioner of agriculture, Col. R. T. Nesbitt, that it is the finest crop of pease he has ever seen in Georgia. They are very thick, and will average 30 inches or more in height.

The fairest test, however, was that of the oats shown in the early part of this letter.

These materials cost me no more than 40 cents per ton.

I have had but little trouble with tin cans and other rubbish mixed with the material. Paper I regard as an advantage, because, like oak leaves, it serves to retain the moisture in the ground. I have never used garbage ashes or garbage tankage.

JOS. M. BROWN.

MUNCIE, IND., *September 10, 1897.*

I have used the street scrapings from the paved streets of Muncie for two years. There are 47 squares, or about 15,000 feet (linear), of paved (sheet asphalt) streets, and we collected from $1\frac{1}{2}$ to 2 tons per day of scrapings. About one-half of the scrapings was scattered direct upon the land; the other dumped off in a large pile—it does not heat or fire-fang. Most of that scattered direct was upon an old timothy sod, thin clay land, and shows no decided results on the present crop of corn, owing to the extremely dry season. That portion that was dumped into a heap I found rotted much quicker and more thoroughly than stable manure with bedding in it. I have used the rotted sweepings upon clay ground for late cabbage and sweet corn, and upon black loam (no sand) for onions and melons.

We put on a heavy coat (3 to 6 inches) before plowing, then thoroughly worked it through with a spring-tooth harrow.

The result was a rank growth of both cabbage and corn. Many a head of cabbage was as large as a half-bushel measure, but soft. None of the cabbage hardened up as it should. The corn did not ear well. For onions and melons it did better than for the other crops.

I used no other fertilizer.

The cost of the manure was the expense of keeping the team and wagons. The city paid for driver. Paper and anything that would rot we put on the ground.

Tin cans, stones, brickbats, wire, and barrel staves were our worst nuisances, and were separated as loaded and unloaded.

STANLEY HATHAWAY.

SEDALIA, MO., *September 9, 1897.*

I have had some experience in regard to the value of the various kinds of offal that accumulate and have to be taken from cities. I have been in the business for about fourteen years, and own a small piece of ground about 4 miles from the city. Street sweepings I regard as worth nothing, from the fact that it is tramped and ground until it is lifeless before it is put upon the ground where it can be plowed under. It will do to fill holes or ditches, the same as straw, and that is all. The garbage from alleys is worth a great deal more, such as falls behind restaurants, hotels, saloons, stables; all are good fertilizers. Tin cans or old bone are good for orchards or grapevines or other fruits, such as berries. Dead animals, no matter what kind, should be buried just a few inches deep, so they do not dry up too quickly and give the earth a chance to absorb the fertilizing substances of the carcass. Horses, mules, cows, or any large animal should be cut in pieces and not placed in one pit. These are good for land that is not yet worn out. But if I wanted to redeem a piece of ground that is considered worn entirely out and make a garden of it, give me that which comes from cleaning privies. Cover the ground with the material and then subsoil it; then repeat the same next year. By the third year your ground will raise potatoes, onions, beets, radishes, beans of any kind, tomatoes, corn, and such, as any huckster or farmer would wish to raise. It should be remembered that subsoiling is one of the main things in all cases where fertilizers of this kind are used. The offal from chicken houses where chickens are dressed or from slaughterhouses is excellent, but the ground must be subsoiled.

W. L. MITCHELL.

BIDDEFORD, ME., *September 29, 1897.*

As to the fertilizing value of street sweepings, I have to say that I have used such materials but one season on old ground, with small results. Cost of material, that of hauling and applying, as the city has furnished same free to all who wish.

JEREMIAH G. SHAW.

ARNOLDS MILLS, R. I., *September 16, 1897.*

I am at the Diamond Hill Reservoir farm of the Pawtucket Waterworks, consisting of about 500 acres of land. I have used street sweepings for four years and find them better than stable or horse manure, for the reason that they contain no straw and are ready for use at any time. The sweepings I get cost nothing except cartage from Pawtucket. When the city sells any the price is \$2 per cord. I have used sweepings for corn and raised 90 bushels per acre. The first year I put on 8 cords to the acre, scattered broadcast and plowed in. The yield was 60 bushels per acre. The season was not a good one for corn. I have used sweepings for oats for fodder and obtained 4 tons per acre.

I use 20 cords a year for grass. The material should be plowed in, as it dries when spread on the surface. The yield of grass was 2 to 3 tons per acre. This manure is swept up with a hand broom, so there are no tin cans or rubbish in it. I do not use any other fertilizer besides the sweepings, and have no trouble in raising any crop I wish.

SAMUEL DARLING.

620 N STREET, SACRAMENTO, CAL., *October 1, 1897.*

I am now putting on my land the sweepings of the asphalt streets of Sacramento, which gives me about three large 2-horse loads per day. The contractor dumps it in a certain place, and I give him \$5 per month for it. There is no straw in it, very little paper, and no tin cans or rubbish, as another contractor picks up the rubbish, ashes, cans, straw, weeds, bottles, shoes, etc., and deposits them in another place. I have a good deal of faith in sweepings, as they seem to be in a proper condition for the roots to take hold of. I put the sweepings direct on the hop hills, without further pulverizing or working over. Some tell me I should compost them by working over and wetting them, as we have no summer showers in this section, our rainy season beginning in October. As we have, off and on, four or five months of rainy weather, and in January and February I begin to plow the hops, I thought it would get in good condition for plant use without working and wetting.

Our white labor costs about \$1 a day and board. Japanese or Chinese, 80 or 90 cents, without board. I put 4 and 5 large shovelfuls to each hill, and after going over all the hills, if there is a surplus, I shall put some between the hills.

As this is my first year with the sweepings, I can not report any results.

DANIEL FLINT.

FINDLAY, OHIO, *October 23, 1897.*

Street sweepings cost me 15 cents per load. I use them without preliminary treatment for garden crops, and consider them very valuable.

M. M. LOWN, M. D.

SAVANNAH, GA., *November 9, 1897.*

Street sweepings, if put together and allowed to ferment and ripen, form a capital top dressing for truck gardens, etc.

J. C. LE HARDY.

HIGHLAND PARK, PITTSBURG, PA., *November 23, 1897.*

I have been using street sweepings in the park for a period of three years and I find it an excellent fertilizer. It has given good satisfaction so far as we have tried it. The soil in the park is of a clayey nature, and I get the best results from applying about 4 to 6 inches, owing to the quality of the soil, then cultivating, rolling, etc., before sowing the lawn seed. With the above treatment our lawns stand the drought, give a rich, green color, and are very pretty. I have not used the street dirt in connection with any crop other than the making of lawns. As to the cost, the hauling from the freight station is the only expense we have. It costs us about 50 cents per cubic yard.

As to the rubbish, there are some tin cans and other materials mixed through it, but it is a small percentage.

GEO. W. BURKE.

BOX 463, PULLMAN, ILL., *November 29, 1897.*

I had some experience thirty-five years since in using street sweepings for a fertilizer from the city of New York, 35 miles distant, brought to the farm by sailboat, but found the material too bulky for the amount of fertilizing matter contained to pay for transportation and handling for use in growing vegetables and the ordinary farm crops and nursery stock.

R. B. HANCE.

MARSHALSEA, PA., *December 6, 1897.*

We have used street sweepings for four years and find it a fine fertilizer. In fact, we use no other kind. We have one 22-acre field, high ground; this field was only a briar patch; would raise nothing. After giving it a coat of street sweepings it produced a fine crop of oats, 45 bushels per acre, and a very heavy crop of English clover. A part of this field was not fertilized with street sweepings. The part not fertilized produced two-thirds less than that part of the field fertilized. Cost of street sweepings, \$6 per car freight, the street department of the city loading car and the insane labor at the farm unloading. We find some tin cans and other rubbish, but this is taken out when unloading car, at a trifling cost.

GEO. LINDERMAN.

LYNCHBURG, VA., *December 13, 1897.*

I have used street sweepings, and I think they are worth to a farmer about two-thirds as much as any stable or cow-pen manure where straw bedding is used. The cost of the same depends on how far they are to be hauled. I never investigated the cost, and used them in top dressing for grapes, which I think gave fine results.

L. F. LUCADO.

NORFOLK, VA., *December 18, 1897.*

I have been using street sweepings for several years with much satisfaction and profit on spinach, cabbage [compare with letter from Mr. Hathaway, of Muncie, Ind., given above.—E. E. E.], kale and potatoes. I haul the material on my farm near where I purpose using it, putting 300 or 400 loads in a heap. I then fork or shovel it over, separating the bricks, tin cans, paper, and other rubbish as thoroughly as I can (a coarse screen would be better). For spinach, I use it broadcast at the rate of 700 bushels per acre; for cabbage, I drill it at the rate of 500 bushels per acre, and ridge the land; for potatoes, I think it better to broadcast, as for spinach and kale. I use from 2,500 to 3,500 carloads of 25 bushels each, and have

been using it for the last ten or twelve years. I use, in addition, about 1,000 carloads of stable manure, and as a rule 300 tons of commercial fertilizer. The street sweepings cost me 20 cents a carload at the dump. The effect on the land where street sweepings are used is much more lasting than where stable manure is used. On "gally" places, that will not grow crops, such a dressing as I have named makes them produce good crops.

THOS. R. BALLENTINE.

PITTSBURG, PA., *December 18, 1897.*

We use street sweepings very largely in our parks and with excellent results. We get the sweepings and dump them in a pile, like a manure heap, 3 to 5 feet deep, driving over it with the wagons, then squaring it up, leaving it sagging a little on top to catch water. It is left in this way for at least a year, or maybe two years, turned once if we have time, and then used as a top dressing on lawns, say one-fourth inch thick, or to mix in with soil in breaking up land, when we use it 1 to 2½ inches deep. It is powerful and quick in its action, and gives a capital growth of grass, and its effect is more lasting than that of artificial manures.

To use it fresh is dangerous, that is, if a heavy dressing is given, and a thin dressing is of little use. To be of any practical benefit, it should be well rotted and well wetted, either by rain or artificial watering from the first; if stacked dry, it "burns." When well rotted, it forms a black mass of humus.

We have 195 carloads of street sweepings in one pile now, all unloaded there this summer; while we were getting them we got in two to three carloads a day. They were emptied and the dumpings piled close by the railroad in a big heap, too big for their good, but we had no time then to take care of them; we left that job till frosty weather, when we could haul them to a more convenient place. In unloading them we throw all big sticks, stones, tin cans, leather straps, iron scrap, etc., aside.

WM. FALCONER.

FURTHER COOPERATION WITH THE DIVISION IN THE STUDY OF THE FERTILIZING VALUE OF STREET SWEEPINGS INVITED.

It is hoped that the information contained in the quotations from letters given above will serve as an inducement for the extension of the use of street sweepings for fertilization, and also aid in developing the best methods for collecting, preparing, and applying the material to the soil. Correspondence is invited with persons interested in the subject, or with farmers or gardeners who have made careful experiments in the use of street sweepings or other forms of city wastes for purposes of fertilization. A knowledge of their methods and results will be of value to others, whether their experiments are successful or unsuccessful. Reports of experiments of this kind possess their maximum value only when the purchase price and cost of hauling, preparing, and applying the fertilizer to the land are stated; when a part of the land is left unfertilized and the crops on fertilized and unfertilized portions of the field are harvested and measured separately; and when the net profit per acre in each case is accurately stated.

MONEY VALUE OF STREET SWEEPINGS.

Without a knowledge of the results of a large number of carefully conducted experiments, it would be hard to determine from the results

of an analysis just what price per ton farmers can afford to pay for street sweepings in addition to the cost of hauling and spreading them on the land. Using the very conservative estimate of 10 cents per pound for the nitrogen, and disregarding the phosphoric acid and potash, the poorest sample analyzed, Serial No. 17034, would be worth 34 cents per ton; while the richest sample, Serial No. 17219, would be worth \$1.46 per ton. The material has considerable value for many soils in addition to the value of the plant food it contains. Gardeners declare that it is very useful for improving the mechanical condition of stiff and badly aerated soils. It would also improve the condition of very light soils which are deficient in moisture-holding capacity because of the low percentage of organic matter which they contain.

The nitrogen of street sweepings is not as readily available as the nitrogen of ordinary stable manure, because of the smaller proportion of urine contained in the sweepings. It is a well established fact that the nitrogen in the urine of animals is much more readily available than that contained in their solid excrement. It is, therefore, very difficult to make an estimate of the money value of street sweepings because of the great variation in their composition, which is dependent upon the nature of the pavements, the season of the year during which they are collected, the manner of collection, etc., and because many accurate field tests must be made before we can determine their exact value as a source of plant food. Sixteen cities reported the prices at which street sweepings are sold to farmers by their street-cleaning departments or contractors. These prices vary from 15 cents to \$2 per ton. The city of Atlanta reports a contract for the sale of the sweepings of their streets for \$60 per year and an arrangement which gives the street-cleaning department the advantage of a short haul. This seems to be an excellent arrangement for both parties concerned, as the average quality of the entire product of a city for a whole year ought not to vary greatly from year to year. Moreover, the price can be adjusted equitably from year to year as the true value of the material becomes apparent.

The expense of hauling can be reduced in a measure by spreading the sweepings in thin layers on the dumping grounds and allowing them to dry out for a day or two before hauling them to the farm. The nitrogen of the material is not of such a form that serious loss would result from this treatment unless it be continued for several days. Long exposure in thin layers during a rainy season would be certain to cause a considerable loss of the most valuable plant food, because that which is most easily leached out is the most readily available.

MISCELLANEOUS WASTE PRODUCTS.

It may often happen that the "dumps" whence the farmer must take his supply of street sweepings, also contain other materials possessing considerable fertilizing value. Any waste animal or vegetable matter,

not contaminated with the germs of diseases of men or animals, may very properly be tested in regard to their value for this purpose. Several hundred pounds of fish refuse, of which the composition is shown in the table of analyses on page 11, were found on one of the "dumps" in Washington, D. C. Its source could not be ascertained. Its fertilizing value, based on data used by the experiment stations for the valuation of fertilizers, would vary from \$9 to \$32 per ton, according to the degree of fineness of the ground material.

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